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Are Musical Autobiographical Memories Special? It Ain't Necessarily So

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We compared young adults' autobiographical (AB) memories involving Music to memories concerning other specific categories and to Everyday AB memories with no specific cue. In all cases, participants reported both their most vivid memory and another AB memory from approximately the same time. We analyzed responses via quantitative ratings scales on aspects such as vividness and importance, as well as via qualitative thematic coding. In the initial phase, comparison of Music-related to Everyday memories suggested all Musical memories had high emotional and vividness characteristics whereas Everyday memories elicited emotion and other heightened responses only in the "vivid" instruction condition. However, when we added two other specific AB categories (Dining and Holidays) in phase two, the Music memories were no longer unique. We offer these results as a cautionary tale: before concluding that music is special in its relationship to cognition, perception, or emotion, studies should include appropriate control conditions.

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Memories of music are thought by many to be a special experience of recall, as they can be particularly vivid and accompanied by strong emotions. As one example, filmmaker Ron Howard captured strong, emotional reminiscence in his documentary on the early touring years of The Beatles called *Eight Days a Week*. In this film, people who attended the famous Shea Stadium concert and journalists who covered the tours recounted their experiences from decades earlier, in vivid terms, as if they were still hearing and seeing the music in their mind.

Described in this way, there is a similarity between autobiographical memories of music and the experience of flashbulb memories (i.e., memories of one's personal circumstances when learning of an important, emotional public event). The latter have been of particular interest to autobiographical memory investigators because of their enhanced phenomenological properties such as vividness, emotional content, and belief in the accuracy of the recollection (Talarico & Rubin, 2009, 2017).

It is widely accepted that music can be a particularly effective cue for event-based autobiographical memories, which are experienced as more vivid than those brought to mind by salient, meaningful visual cues (Belfi, Karlan, & Tranel, 2016). Interestingly, Belfi and colleagues (2016) found that music cues were less effective in generating autobiographical memories than were pictures of famous people; however, the memories retrieved in response to music cues were more vivid than picture-evoked memories. There are also reports of music enhancing autobiographical remembering among those with Alzheimer's disease (El Haj, Postal, & Allain, 2012; Jacobsen et al., 2015: but see Baird & Samson, 2009, for note of caution). However, in each of these contexts, the music is not necessarily a component of the original autobiographical memory; rather, it is an aspect of the retrieval context that leads to redintegration of an autobiographical event in memory. Hence it remains unclear whether the mere presence of music as part of an autobiographical event can lead to a special, enhanced form of autobiographical memory. Our question was concerned with the content of memories that emerged from verbal probes to retrieve autobiographical events. Specifically, we asked whether autobiographical memories that include music are more likely to be "special" in terms of being more vivid, compared to other autobiographical memories that lack any musical content.

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Typically, vividness in autobiographical memory is associated with visual processing. In support of this finding, neuropsychological work has shown that impairment of long-term visual memory simultaneously results in impairment of autobiographical remembering in the absence of damage to brain areas more commonly associated with memory (Greenberg, Eacott, Brechin, & Rubin, 2005). Similarly, the description of severely deficient autobiographical memory in otherwise healthy adults includes profoundly impaired delayed recall of visual information (Palombo, Alain, Söderlund, Khuu, & Levine, 2015). However, memories of music may be an example where the visual components of autobiographical memory are less important than the auditory components. Therefore, showing that memories of music are more likely to be vivid than other (more visually oriented) autobiographical memories would have implications for our understanding of mnemonic processing.

In the present paradigm, our instructions for cued recall focused participants on the contents and phenomenological features of their autobiographical memories. In a within-subjects comparison, participants were asked to recall their "most vivid memory" and to recall "any other event from your life." In this way, we compare memories that differ in self-reported vividness within individuals, while controlling for individual differences in visual imagery or recollection (Rubin, Schrauf, & Greenberg, 2003). Whether the two cued memories were restricted to those "involving music" was manipulated between subjects. Therefore, participants were not aware of the contrast between musically related and non-musically related memories when providing responses and therefore demand characteristics regarding the "special" status of music-related memories were reduced. By emphasizing variability in vividness, even within music-related memories, we should also bias the data against our hypothesis of observing enhanced vividness within musical memories.

Overall, we were pursuing the idea that "music is special," a claim that has surfaced from time to time in the wider literature. Related ideas have included the Mozart Effect (Chabris, 1999; Rauscher, Shaw, & Ky, 1993; Thompson, Schellenberg, & Husain, 2001), suggestions that music training can enhance skills in other domains (Brandler & Rammsayer, 2003; Hansen, Wallentin, & Vuust, 2013; Helmbold, Rammsayer, & Altenmüller, 2007, Schellenberg, 2004), that music is uniquely suited for therapeutic contexts (Altenmüller & Schlaug, 2013; Bradt, Dileo, Magill, & Teague, 2016; Witzke, Rhone, Backhaus & Shaver, 2008), and that memory for music differs from other kinds of memory (Barrett et al., 2010; Halpern & Bartlett, 2011). We offer this narrative not to dispute any of these claims, but as a cautionary tale about adopting the "music is special" argument in empirical work, the reason for which will become evident as we describe the two phases of our research into musical autobiographical memories.

The present experiment comprised two phases. In the initial conception of the experiment (Phase 1), we compared the characteristics of verbally cued musical memories to non-musical memories both for memories that participants considered particularly vivid and those that they considered more ordinary. On completion of Phase 1, we tentatively concluded that musical autobiographical memories were special and in fact presented those data at two conferences. However, our own thinking, and input from people attending our presentations, led us to reconsider that conclusion. We questioned the robustness of this interpretation given that we had not also probed other specific categories of autobiographical memories. In Phase 2 we added two additional cued categories: memories of dining experiences and holidays/celebrations. Although our main analysis eventually included all four types of memories, here we present the narrative as originally conceived, for two main reasons. First, the analyses in the two phases were somewhat different (for instance, the coding in Phase 2 used the codebook developed in Phase 1). More relevant to one of main points, is that this order of presentation serves to emphasize the "cautionary tale" aspect of our work.

Phase 1

METHOD

Participants. Forty-one undergraduate students (10 male, 30 female, 1 gender undisclosed) between the age range of 18 to 22 participated in Phase 1. All were students at Lafayette College. Twenty-one of the students (13 female) provided memories related to Music.

Materials. Participants were asked to provide short written responses and ratings regarding two personally experienced life events: one that they self-identified as being particularly vivid and one that they self-identified as being ordinary. Half the participants were asked to consider memories that specifically involved Music whereas the other half were not given any category instructions.

The autobiographical memory questionnaire we used was adapted from prior work in flashbulb memory (Talarico & Rubin, 2003) and required qualitative reporting on the chosen event followed by quantitative

rating on its characteristics. First, participants were asked to describe the canonical features of their chosen memory; i.e., "What was the event?," "When did this event occur?," "Where were you, physically?," "Were there others present, and, if so, who?," "What were you, personally, doing?," and "What was your dominant emotion at the time of the event?" The final question included one of the key elements of flashbulb memory, whether there were "distinctive details from the event." The accompanying set of quantitative rating questions were drawn from the Autobiographical Memory Questionnaire (AMQ; Rubin et al., 2003) and were designed to assess recollection, vividness, belief in memory accuracy, personal significance, emotionality, and degree of rehearsal relating to the memory. Event features of surprise and importance were also assessed on similar 7-point rating scales.

For the Music-related memories condition only, participants were asked six additional questions: "How was music involved in this event?," "How were you, personally, involved with the music during this event?," "If you were listening to music, was is recorded or live?," "Were you alone or with other listeners?," "If you were playing music, were you practicing or performing for an audience?," and "Were you playing alone or with other musicians?" Participants also completed the Goldsmith's Musical Sophistication Index (Gold MSI: Müllensiefen, Gingras, Musil, & Stewart, 2014) after all other measures had been collected.

PROCEDURE

Data collection. After providing informed consent, participants read general instructions. All participants were asked to use the paper questionnaire to describe "their most vivid autobiographical memory" (Music-related or not, depending on condition) and to rate the characteristics of that memory. The participants in the Music condition immediately completed the additional questions about the musical content of their chosen memory. All participants then completed the qualitative and quantitative questions about "any other event from your life . . . that occurred in roughly the same time period as the event described above" (Music-related or not, depending on condition). Finally, participants provided information on demographics such as age and gender.

Coding. The qualitative data of the event descriptions were coded using a basic form of Applied Thematic Analysis that has been adapted for use in studies of musical experiences (ATA; Guest, MacQueen, & Namey, 2012; Alessandri, Williamson, Eiholzer, & Williamon, 2015; Williamson & Jilka, 2013; Williamson et al., 2012). ATA is an approach to text analysis where the core principle is that the data are the basis for any analysis decision. Hence the reduction of data to useable quotes, the coding and extraction of themes from the text, and their interpretation are all processes that remain grounded in the form of data collected, so are idiosyncratic to each study.

Following this ATA-inspired approach, a protocol was applied to the questionnaires that began with a basic data reduction (cleaning) followed by coding and theme generation and analysis. First, the text responses were transferred by one individual from the paper questionnaire into a spreadsheet; as part of this process the data were reduced to text segments that each presented one core message. The instruction provided was to remove any text not related to the prompt or that replicated a core idea. Then, the reduced text segments were analyzed using a dual coder protocol (designed and developed by Williamson et al., 2012, and Williamson & Jilka, 2013) that helps reduce subjectivity. The aim of this method is to first generate a set of codes that summarize the long text data, as they are understood by two independent coders, and then to organize them into short theme labels that represent the key concepts expressed in the data. These "themes" can then be compared across different conditions.

First, we provided basic training on line by line coding and theme development, as detailed in the references above. Then each coder read the text segments in isolation and generated codes for all the statements. These codes were recorded as they emerged and each coder aimed to use them consistently when further examples were found in the data. Hence each coder developed her own "code book" that effectively summarized the content of the participants' memory descriptions. The coders then came together for an analysis session where they took turns presenting each of their codes and gave examples from the data to support their decision. From these code comparisons, agreed theme labels were generated and a final dual-input codebook for the dataset was created.

The final stage of analysis resulted in the emergence of several themes: type of event, age when the event happened, location, who else was present, what the person was doing, and emotion experienced. An "other" theme was included to represent miscellaneous remarks such as the weather, clothing worn, etc. Musical memories were coded by type of situation, such as listening, performing, or practicing. The absence of detail was also coded when appropriate. For instance, under Emotion, if the report said there was no particular emotion involved, that was coded as "neutral," or under Doing What, if the

person said he or she was doing nothing in particular, that was coded as "nothing of significance."

Scoring. The rating questions were grouped partially into smaller variables that represented features of autobiographical recall, related especially to the experience of flashbulb memories. ***Recollection*** was assessed by averaging responses to "I feel as though I am reliving" the experience (from 1 = *not at all* to 7 = *as clearly as if it were happening now*) and "while remembering the event now, I feel that I travel back to the time it happened" (from 1 = *not at all* to 7 = *completely*). ***Belief*** in the accuracy of the memory was a single item, "I believe the event in my memory really occurred in the way I remember it" (from 1 = *100% imaginary* to 7 = *100%* real). Vividness was assessed with two questions about perceptual detail: ratings of how well participants could "***see*** it in my mind" and "***hear*** it in my mind" (both from 1 = *not at all* to 7 = *as clearly as if it were happening now*). Although these items are frequently averaged in the autobiographical memory literature, we retained the distinction here due to particular interest in the auditory aspects of memories including music. ***Personal significance*** was assessed by a single item, "This memory is significant to my life because it imparts an important message for me or represents an anchor, critical other memory juncture, or turning point" (from 1 = *not at all* to 7 = *more than any other memory*). To assess ***rehearsal***, participants indicated the degree to which they "thought about" and "talked about" the memory (both from 1 = *not at all* to 7 = *more than for any other memory*).

Emotion was assessed by asking about the current emotional ***affect*** and ***intensity*** of the memory. Participant ratings of how "negative" the emotions they feel while remembering the event were reverse coded and averaged with ratings of how "positive" the emotions they feel while remembering the event (both from 1 = *not at all* to 7 = *entirely*). We also asked a series of questions about physical emotional reactions: "I feel my heart pound or race," "I feel tense all over," "I feel sweaty or clammy," and "I feel knots, cramps, or butterflies in my stomach" (all rated from 1 = *not at all* to 7 = *more than for any other memory*) and we collapsed these in to one ***visceral response*** measure. Participants also rated consistency of emotional affect and intensity, by answering if they felt the emotions "as strongly as I did then" (***same intensity***: from 1 = *not at all* to 7 = *as clearly as if it were happening now*) and if they felt "the same particular emotions I felt at the time of the event" (***same emotion***: from 1 = *completely different* to 7 = *identically the same*).

To assess surprise of the events, participants were asked to rate (from 1 = *not at all* to 7 = *completely*) how "surprising," "unusual," "ordinary," and "expected" the event was. These were collapsed to form a measure of ***surprise*** (with the latter two items being reverse-scored). In addition, participants indicated how important the event was (from 1 = *not at all* to 7 = *very important*) to them "personally," to their "family and friends," to their "country," and "internationally." The former two were averaged to create a ***local importance*** scale and the latter two were averaged to create a ***global importance*** scale.

RESULTS

First, we examined the Gold MSI to determine the musical sophistication of our sample. There was no significant difference between participants who recalled Everyday memories ($M = 65.80$, $SEM = 2.07$) and those who recalled Music memories ($M = 66.81$, $SEM = 1.61$) on the subset of questions characterized as General Music Sophistication, $t(39) = 0.39$, $p > .70$. Given that the maximum score on that scale is 125, our sample was modest in musical sophistication. Most participants said that they played an instrument (with only three participants in the Everyday memory condition and two participants in the Music memory condition indicating that they did not). The most common responses to the question were piano ($n = 14$, 6 in the Everyday memory group and 8 in the Music memory group) and voice ($n = 11$, 7 in the Everyday memory group and 4 in the Music group).

The resulting dataset included memories in four categories: vivid Musical, ordinary Musical, vivid non-musical (Everyday), and ordinary non-musical (Everyday). Vivid and ordinary memories were self-selected by participants cued to recall either Music-related or Everyday autobiographical memories. To preview our results, vivid Everyday memories differed from ordinary Everyday memories in several respects relating to their vividness and emotional content, as would be expected, but these differences were rarely present between the vivid and ordinary Musical memories. Sample memory reports from two participants (one from the Music condition and one from the Everyday condition) are included in the Appendix.

To summarize the main outcomes of the qualitative analysis, ordinary non-musical memories were approximately half as likely to include physical descriptions (25% vs. 43–48%) and nearly twice as likely to not include any distinctive details (45% vs.19–29%) as were the other three memory types. These ordinary, Everyday memories were also less likely to include references to

TABLE 1. *Descriptive Statistics for Quantitative Variables Across Both Phases of the Study*

	Everyday ($n = 20$)				Music ($n = 21$)				Holiday ($n = 25$)				Dining ($n = 23$)			
	Vivid		Ordinary		Vivid		Ordinary		Vivid		Ordinary		Vivid		Ordinary	
	M	*SEM*	*M*	*SEM*	*M*	*SEM*	*M*	*SEM*	*M*	*SEM*	*M*	*SEM*	*M*	*SEM*	*M*	*SEM*
Recollection	5.63	0.29	4.13	0.35	5.00	0.28	4.71	0.34	4.62	0.26	4.12	0.32	4.70	0.27	3.61	0.33
See	6.40	0.24	5.00	0.33	5.95	0.24	5.48	0.32	6.28	0.22	4.88	0.30	5.78	0.23	4.96	0.31
Hear	5.25	0.40	3.30	0.41	5.00	0.39	4.52	0.40	4.28	0.36	3.40	0.37	4.44	0.37	3.39	0.39
Belief	6.15	0.23	5.45	0.34	5.67	0.23	5.48	0.33	6.12	0.21	5.54	0.30	6.13	0.22	5.48	0.31
Significance	5.20	0.38	3.25	0.45	4.10	0.37	3.71	0.43	3.68	0.34	3.28	0.40	3.26	0.36	2.91	0.42
Rehearsal	4.48	0.24	3.10	0.34	3.83	0.24	3.45	0.33	3.30	0.22	2.72	0.30	3.15	0.23	2.46	0.32
Intensity	4.85	0.32	2.65	0.42	4.10	0.31	3.52	0.41	3.56	0.29	3.00	0.37	3.87	0.30	2.57	0.39
Affect	5.25	0.49	5.13	0.42	5.64	0.48	5.88	0.41	5.82	0.44	4.80	0.37	5.26	0.46	6.04	0.39
Visceral Responses	3.04	0.25	1.63	0.26	2.25	0.25	2.04	0.26	1.79	0.23	1.84	0.24	1.63	0.24	1.59	0.25
Same Emotions	4.50	0.34	3.75	0.38	4.14	0.33	3.91	0.37	4.40	0.30	3.84	0.34	4.74	0.31	4.04	0.35
Same Intensity	4.20	0.36	3.00	0.35	3.14	0.36	2.91	0.34	3.52	0.33	2.92	0.31	3.70	0.34	2.74	0.32
Surprise	4.90	0.36	3.15	0.40	4.01	0.35	3.43	0.39	4.02	0.32	3.10	0.36	3.88	0.33	2.12	0.37
Local Importance	5.85	0.34	3.73	0.39	5.05	0.33	4.57	0.38	4.84	0.31	4.48	0.35	4.50	0.32	3.98	0.36
Global Importance	1.25	0.25	1.48	0.28	1.33	0.24	1.57	0.28	1.72	0.22	1.80	0.25	1.59	0.23	1.13	0.26

TABLE 2. *Inferential Statistics for Phase 1 (2 x 2 Multivariate Mixed Factorial ANOVA)*

	Main Effect of Memory Type (vivid vs. ordinary)			Main Effect of Memory Category (Everyday vs. Music)			Interaction		
	F (1, 39)	p	η_p^2	F (1, 39)	p	η_p^2	F (1, 39)	p	η_p^2
Recollection	11.05	.002	.22	0.00	.96	.00	5.11	.03	.12
See	23.42	< .001	.38	0.00	.96	.00	5.68	.02	.13
Hear	11.99	.001	.24	1.21	.28	.03	4.42	.04	.10
Belief	5.93	.02	.13	0.42	.52	.01	1.94	.17	.05
Significance	10.44	.003	.21	0.62	.44	.02	4.73	.04	.11
Rehearsal	12.91	.001	.25	0.20	.66	.01	4.14	.05	.10
Intensity	16.93	< .001	.30	0.03	.86	.00	5.81	.02	.13
Affect	0.02	.89	.00	1.31	.26	.03	0.22	.64	.01
Visceral Responses	12.16	.001	.24	0.60	.44	.02	6.60	.01	.15
Same Emotions	2.72	.11	.07	0.10	.76	.00	0.73	.40	.02
Same Intensity	5.13	.03	.12	2.62	.11	.06	2.36	.14	.06
Surprise	9.10	.004	.19	0.73	.40	.02	2.28	.14	.06
Local Importance	21.26	< .001	.35	0.00	.95	.00	8.54	.01	.18
Global Importance	0.99	.33	.03	0.13	.72	.00	0.00	.98	.00

emotion codes such as happiness, the dominant emotion code (included in at least 33% of reports from the other three memory types), than the other memory types. Similarly, age of the memories indicated that the plurality (at least 45%) were from the teenage years, across all four memory types.

The quantitative data (shown in Table 1) were analyzed with a 2 (memory type: vivid vs. ordinary) x 2 (instruction condition: Everyday vs. Musical) multivariate mixed factorial ANOVA (see Table 2). ***Recollection***, ***see, hear***, ***significance***, ***rehearsal***, ***emotional intensity***, ***visceral responses***, and ***local importance*** all showed significant interactions and main effects of memory type. In each case, simple effects analysis (with Bonferroni correction) demonstrated increased ratings for vivid Everyday memories relative to ordinary Everyday memories, all $t(19) \geq 3.41$, $p < .005$, but these differences were not found for Musical memories, all $t(20) = \leq 1.30$, $p > .10$. ***Belief***, ***same intensity***, and ***surprise*** showed no interaction, but did show a main effect of memory type. For the main effects of memory type, vivid memories showed higher ratings than did

ordinary memories in every case. Emotional ***affect***, ***same emotion***, and ***global importance*** showed no main effects nor a significant interaction. No variables showed main effects of condition.

INTERIM DISCUSSION

The descriptive thematic outcomes and quantitative interaction effects observed in Phase 1 were consistent with our hypothesis that musical autobiographical memories are "special." Ordinary Musical memories were more similar to vivid Musical memories and vivid Everyday memories than were ordinary Everyday memories. In other words, Vividness differentiated Everyday memories more so than Musical memories. This finding suggested that musically related autobiographical memories may more typically have features akin to flashbulb memories compared to other autobiographical memories.

One problem for this conclusion, as alluded to earlier, is that the search space for non-musical memories was considerably larger than the one for musical memories, given that it was a constrained category. We determined that to eliminate this confound, we needed to test memories drawn from a similarly narrow semantic category. Furthermore, the new category needed to be as similar to musical memories as possible, particularly in the inclusion of salient emotional and/or sensory characteristics, to more strongly test the hypothesis that musical memories are "special." Thus we replicated our design with two new categories, and re-analyzed the entire set of data.

Two new non-musical categories were added to the paradigm for a more robust test of the differences among musical and non-musical autobiographical memories. Students were asked to recall vivid and ordinary memories of Holidays/Celebrations or Dining experiences. These were selected as appropriate semantic categories to compare to musical memories because of the ubiquity of such events in people's lives, and the potential to include particularly vivid as well as ordinary memories. Similar to music being associated with the sense of hearing, Dining was likely to be strongly associated with a particular sense modality—in this case, taste. Our other cue of Holidays would likely trigger memories that were accompanied by strong emotions as well as multi-sensory features (e.g., sights like Christmas lights or holiday decorations, scents of birthday or menorah candles, tastes of Thanksgiving turkey, or Easter candy, etc.). Pilot testing of the Phase 1 qualitative coding protocol for these two semantic categories also showed high agreement between the emergent themes extracted by the two coders, another reason that supported their inclusion as a comparison to Music memories.[1]

Phase 2

METHOD

Participants. A new group of 48 participants from Lafayette College (aged 17–22) was recruited. Each participant completed one of two questionnaires that asked about an ordinary and a vivid memory: Holidays ($N = 25$, 18 females) and Dining ($N = 23$, 15 females).

Materials and procedure. The main materials and procedure were the same as in Phase 1, simply adapted to include reference as part of the introduction to the questionnaire to either the Dining or Holiday category. The Gold MSI was not administered.

Coding. The data reduction, coding, and analysis methods matched that used in Phase 1, with the key exception that the two research assistants did not seek to develop their own code books this time, but rather independently coded the text responses from each of the new semantic categories using the final code book generated in Phase 1. Coding also focused on the three superordinate themes that were relevant to all the memories, in order to allow for effective comparison; type of detail reported (***Detail***), type of specific emotion reported (***Emotion***), and the time frame of the memory (***When***).

For ***Details***, there were initial differences between Holiday/Dining and Everyday/Music coding categories. The Holiday/Dining details data were coded as: "Emotional," "Physical," or "None." The Everyday/Music data details were coded as: "Emotional," "Physical," "Outfit," "Weather," or "None." In order to look at the data consistently across all types of memories the data categorized as "Outfit" or "Weather" were combined with "Physical." Coding themes for "Emotion" had to be similarly adjusted.

Emotion data for Holiday and Dining memories were coded as: "Positive," "Negative," or "Neutral." The data for Everyday and Music memories initially coded as: "Confidence," "Excited," "Happy," "Fear," "Nervous," "Pain," "Sad," or "Neutral." "Confidence," "Excited," and "Happy" were grouped as "Positive." Then "Fear,"

[1] This pilot testing stage also included "Sports" as a category on the basis that it shared the performance/spectator dimension with music and because it was the most frequently occurring event-type within non-musical vivid memories in Phase 1. However, we decided to omit this category on the basis that musical memories did not differ along that dimension, and because coding within this category proved to be difficult with low levels of interrater agreement.

"Pain," and "Sad" were grouped as "Negative." The "Neutral" category remained as it was.

Lastly, Holiday and Dining memories were coded as having occurred: "> 6 months ago," "1+ years ago," "3+ years ago," "5+ years ago," and "N/A." Everyday and Music memories were coded as: "Young Adult," "Teenage," "Childhood," and "Early Childhood." In order to synthesize the ***Age of the Memory*** data sets, three new categories were created: "Recent," "Early Past," and "Late Past." "Recent" consists of: "> 6 months ago" / "1+ years ago" as well as "Young Adult." "Early Past" consists of: "3+ years ago" and "Teenage." "Late Past" consists of "5+ years ago," "Childhood," and "Early Childhood." The "N/A" responses were not included.

Discussion was sufficient to deal with minor discrepancies in emergent theme names in order to reach a consensus on appropriate theme labels. A codebook was created that detailed a definition and description of each theme within each category.

Scoring. The quantitative variables were scored identically as in Phase 1.

RESULTS

The final dataset included responses from 20 respondents in the Everyday condition (Phase 1), 21 in the Musical condition (Phase 1), 25 in the Holiday condition (Phase 2), and 23 in the Dining condition (Phase 2). All participants generated both a particularly vivid and an ordinary memory within each category, generating a total of 178 memories. Because the number of memories varied in each category, all analyses were done on proportions rather than raw frequency.

Coding. Themes are presented below under each of the three superordinate categories of Detail, Emotion, and When. Histograms for each theme can be found in Figure 1.

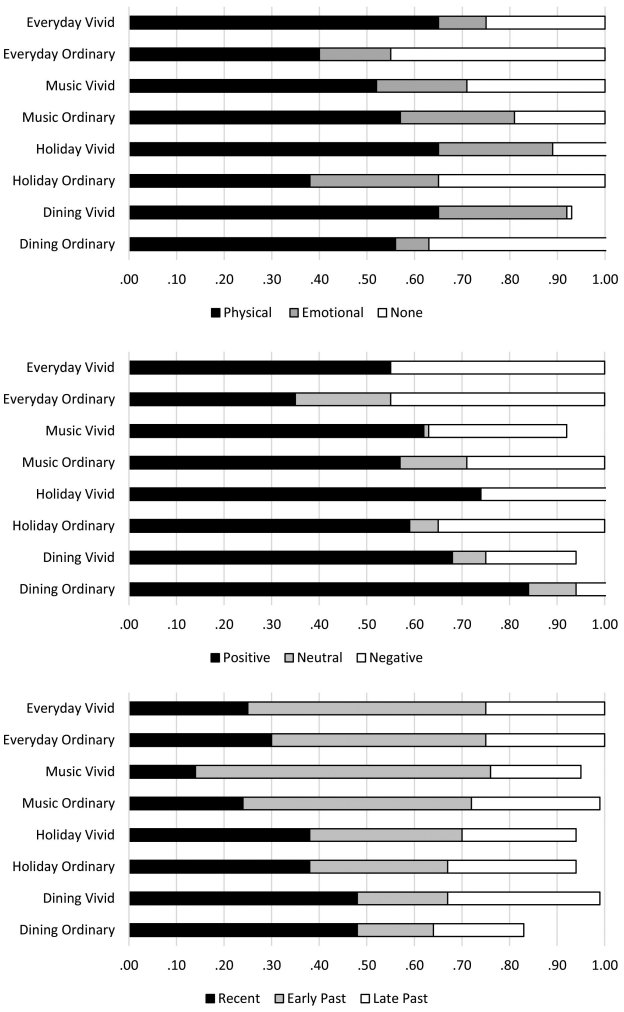

FIGURE 1. Distribution of qualitative themes, Details (top panel), Emotions (middle panel), and Age (bottom panel) across all memory categories. Not all groups add to 1 due to rounding and omissions.

1. **Detail.** For most memory types, the majority of reported memories were coded as having a ***Physical*** detail, the exceptions were ordinary Holiday memories and ordinary Everyday memories where only 38% and 40% of reports, respectively, included ***physical*** details. Holiday and Everyday memories also showed the greatest difference in distributions between vivid and ordinary memories. In no comparisons did Music memories seem dramatically different from the other memory categories.
2. **Emotion.** Again, the distribution of data for Dining, Holiday, Music, and Everyday memories were very similar in the "Emotion" Category. The majority of memories were coded as ***positive***, again with the exception being Everyday, ordinary memories where 35% of reports were ***positive*** versus 45% that were ***negative***. The memory categories varied as to whether vivid or ordinary memories included more ***positive*** emotions. Vivid Music memories included more ***positive*** emotions than did ordinary Music memories. Everyday memories and Holiday memories showed the same pattern between vivid and ordinary memories, but to a larger degree. Dining memories, however, showed more ***positive*** emotions in ordinary than in vivid memories.
3. **Age of Memory**. In this theme, there was more variability among the different types of memories.

TABLE 3. *Inferential Statistics for Phase 2 (2 x 4 Multivariate Mixed Factorial ANOVA)*

	Main Effect of Memory Type (vivid vs. ordinary)			Main Effect of Memory Category (Everyday vs. Music vs. Holiday vs. Dining)			Interaction		
	F (1, 85)	p	η_p^2	F (3, 85)	p	η_p^2	F (3, 85)	p	η_p^2
Recollection	22.42	< .001	.21	2.11	.11	.07	2.31	.08	.08
See	38.47	< .001	.31	0.52	.67	.02	1.87	.14	.06
Hear	23.76	< .001	.22	1.80	.15	.06	1.81	.15	.06
Belief	16.21	< .001	.16	0.25	.86	.01	0.74	.53	.03
Significance	8.77	.004	.09	2.73	.05	.09	2.15	.10	.07
Rehearsal	19.42	< .001	.19	4.58	.01	.14	1.46	.23	.05
Intensity	26.17	< .001	.24	1.29	.28	.04	2.81	.04	.09
Affect	0.01	.905	.00	0.60	.62	.02	2.34	.08	.08
Visceral Responses	6.66	.012	.07	2.86	.04	.09	4.45	.01	.14
Same Emotions	7.91	.006	.09	0.33	.80	.01	0.32	.81	.01
Same Intensity	12.17	.001	.13	0.80	.50	.03	0.91	.44	.03
Surprise	27.62	< .001	.25	2.48	.07	.08	1.53	.21	.05
Local Importance	16.08	< .001	.16	0.95	.42	.03	3.51	.02	.11
Global Importance	0.02	.900	.00	1.16	.33	.04	0.92	.44	.03

For the Everyday and Music categories, the plurality of memories were from the ***early past*** whereas for Holiday and Dining memories, the plurality were coded as ***recent***. All categories showed roughly equal proportions of memories drawn from the ***late past***. Similarly, none of the memory categories showed much difference in the age distributions for ordinary and vivid memories.

Scoring. With the addition of the new conditions, all the quantitative data (see Table 1) were reanalyzed using a 2 (memory type: vivid vs. ordinary) x 4 (instruction condition: Everyday vs. Musical vs. Holiday vs. Dining) multivariate mixed factorial ANOVA (see Table 3). The main effects of memory type remained the same except that differences in ***same emotions*** were now found to be significant. We did find main effects of memory category in ratings of ***personal significance***, ***rehearsal,*** and ***visceral responses***; however, they were not as we predicted. In other words, Musical memories were not different from any of the other categories. Instead, Dining memories showed significantly lower ratings in personal significance and visceral emotions than Everyday memories according to post hoc Tukey HSD tests. For rehearsal, post hoc Tukey HSD tests showed that Everyday memories and Music memories (which were not different from each other) were rated significantly lower than memories of Dining. Similarly, the failure to find differences between ordinary and vivid memories within Music memories that had been of interest initially were not repeated as expected here. Only three variables showed a significant interaction between memory type and condition: ***emotional intensity***, ***visceral responses***, and ***local importance***. Simple effects analysis (with Bonferroni correction) showed that the primary driver for these effects was the Everyday condition, not the Music condition. The difference between vivid and ordinary memories was significant for the Everyday condition in all three cases, $t(19) = 5.01$, 3.41, and 5.20 respectively, all $p < .005$. That difference was also significant for the Dining memories, but only for ratings of ***intensity***, $(22) = 3.08$, $p < .05$, (not ***visceral responses*** or ***local importance***, $t(22) = 0.15$ and 1.22 respectively, both $p > .20$). There was no difference between vivid and ordinary memories on ***intensity***, ***visceral reactions*** or ***local importance*** within Holiday, $t(24) = 1.30$, -0.16, and 0.76 respectively, all $p > .20$, or Music, $t(20) = 1.12$, .94, and 1.22 respectively, all $p > .20$, memories.

General Discussion

Although initial comparisons between musical and non-musical autobiographical memories seemed to support a "music is special" narrative, upon further analysis with additional experimental control in the form of two other semantic categories, that distinction disappeared. The differences we found in Phase 1 between musical and non-musical autobiographical memories appear to be due to a semantic-category cueing effect rather than to the idea that personally experienced, musically related memories have features more

akin to flashbulb memory than other forms of autobiographical memory, per se. This conclusion is supported by the fact that the differences we saw between vivid and ordinary memories within the initial two conditions remained robust in Phase 2 (thus validating participant compliance with our instructions), but the similarity across that within-subjects dimension that was present for music-related memories was also seen for Dining and Holiday memories. In some domains, the new categories showed the deviant pattern. For instance, Dining showed the largest difference in Detail between vivid and ordinary, perhaps because we eat many meals, and vivid dining experiences may be rare relative to the thrice-daily routine dining experiences. On the other hand, Dining elicited fewer emotions than other categories, perhaps suggesting that fine or memorable meals are more an aesthetic than emotional experience. It may still be that musical memories are special in some ways, but not in the ways that we assessed or to a degree that our study was sufficiently sensitive to detect. It may be that verbal cues are insufficient for bringing truly special musical memories to mind.

However, the larger point here in our "cautionary tale" is that sometimes both in the scholarly literature (including some of the references we cited earlier) and in publications and presentations meant for the general public, music is often offered as an example of a unique domain. Of course, understanding music processing per se is of great interest to many psychologists and neuroscientists, for all kinds of valid reasons. Music is a domain that unusually combines nonverbal messages, that are structured over time, that convey emotion, and in which we can find less and more expert listeners and producers. But to conclude that music is "special" may be premature in cases where there is no assessment of other domains that share at least some of these characteristics.

This is particularly important when claims are made for unique therapeutic applications. For instance, Samson, Clément, Narme, Schiaratura, and Ehrlé (2015) reported on an intervention for patients with dementia that contrasted music activities with what appeared to be a good active control: cooking activities. In their first study, the music intervention appeared to enhance mood and other measures of well-being more than cooking, in a post-to-pretest design. However, it turned out that the music and cooking activities were not completely matched; different therapists administered the different interventions and the outcome measures that required subjective ratings were done by an evaluator not blind to condition. When those issues were ameliorated in a follow-up study, music and cooking did not differ in their effectiveness. The change in results suggested that at least to some extent, prior beliefs in the special status of music might have affected the outcomes.

More generally, many studies claiming a special status for musicians or music training have not included a contrast category either in participants and/or domains. For instance, Besson Faïta, and Requin (1994) compared ERP responses to detection of incongruity of the final note in a melody. Enhanced response was found among musicians, but only a musical task was given. Other researchers do generalize the task but not a contrast category for participants. Brandler and Rammsayer (2003) gave a series of nonmusical cognitive tasks to musicians and nonmusicians. The musicians were superior in verbal memory that the authors attribute to training. However, the directionality issue of self-selection to engage in music training is, in fact, ambiguous. In addition, we do not know if the nonmusicians had expertise in any other particular skills. Highly trained athletes, cooks, or chess players may be more comparable control groups in studies like this in much the way that memories of other relatively narrow semantic categories were a better control than undefined Everyday autobiographical memories were in the current study. A similar logical issue can be found when looking at neural activity differences in musicians and nonmusicians (e g., Schön, Magne, & Besson, 2004).

A number of training studies that look at short-term music training effects in children have included an active control, sometimes with surprising outcomes. For instance, Schellenberg (2004) randomly assigned children to music or drama lessons or no lessons, and found that music lessons enhanced some cognitive tests to a small degree, but drama lessons strongly enhanced a measure of social behavior. Similarly, Roden et al (2014) used natural science lessons as an active control for music lessons, and found that music lessons enhanced processing speed, but intense training in science enhanced visual attention.

In that spirit, had we not pursued some contrast semantic categories (which as we mentioned, was partly inspired by comments we received at two conferences where we presented Phase 1), we too would have concluded that musical memories have a unique status: that ordinary musical memories were as vivid as memories *cued* to be *self-selected* as vivid, drawn from general autobiographical memory. Just having a musical aspect to the memory seemed initially to be associated with enhancements in many of the characteristics associated

with vivid autobiographical memories. This finding would have added in a circular way to the general beliefs about the specialness of music, which in turn could affect the outcomes of other studies, as described in the Samson et al. (2015) example.

We therefore recommend to our fellow music psychology researchers to consider the necessity of including well-matched, active control groups or conditions, when assessing how music might differ from processing of other material. Researchers who compare music and language do often consider these similarities and differences (for example, Patel, 2010). We hope our cautionary tale will encourage this approach more broadly.

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Appendix

EVERYDAY MEMORY REPORTS

Please describe in detail your **most vivid autobiographical memory**.

What was the event?
When I found out that X had died

When did this event occur?
About a year ago – May 5th

Where were you, physically?
I was in M, in my dorm room (#), sitting on my bed on my computer

Were there others present, and if so, who?
No, I was by myself

What were you, personally, doing?
I was studying for finals and also on Twitter when I saw my friend tweet first to "pray for X" and then minutes later "RIP X"

What was your dominant emotion at the time of the event?
Shock, disbelief, sadness, emptiness

Are there any other distinctive details from the event?
There are so many – I can remember it like a play-by-play

Please describe in detail **any other event from your life** that occurred in roughly the same time period as the event described above.

What was the event?
My final meeting w/ coaches for S

When did this event occur?
At the end of last school year, about a week or two before finals

Where were you, physically?
I was in my coach's office

Were there others present, and if so, who? Yes, our head coach and assistant coach

What were you, personally, doing?
I was sitting and coach was telling me about my progress and where I would be next year and what my goals should be

What was your dominant emotion at the time of the event?
A little nervous

Are there any other distinctive details from the event?
No

MUSICAL MEMORY REPORTS

Please describe in detail your **most vivid autobiographical memory involving music**.

What was the event?
Piano competition at P

When did this event occur?
Junior year of high school, in the spring

Where were you, physically?
PU, in the theater building. It was a sunny day

Were there others present, and if so, who?
Yes, other people waiting to play for the judges

What were you, personally, doing?
Playing Moonlight Sonata by Beethoven for two judges

What was your dominant emotion at the time of the event?
NERVOUS! My hands were shaky and I was sweaty but once I started playing I became less anxious. I remember feeling relieved when it was over.

Are there any other distinctive details from the event?
I remember wearing a blue blouse with a black skirt

Please describe in detail **any other event from your life involving music** that occurred in roughly the same time period as the event described above.

What was the event?
Prom junior year

When did this event occur?
Junior year of high school (about a month after the piano competition)

Where were you, physically?
CT in Philadelphia

Were there others present, and if so, who? Yes, the junior and senior class of my high school. I was with all my closest friends

What were you, personally, doing?
Dancing, eating, socializing

What was your dominant emotion at the time of the event?
Happy to be with my friends, relaxing and having a good time

Are there any other distinctive details from the event?
I remember slow dancing with my date who I had a crush on to the song "All my life"